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Prevalence and determinants of Acute Respiratory Infections in children under five in rural mysuru: insights from a cross-sectional study

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ABSTRACT

Background

Acute Respiratory Infections (ARIs) remain a leading cause of morbidity and mortality in children under five years of age, particularly in rural regions. Understanding the prevalence and determinants of ARIs in such settings is essential for developing targeted interventions. This study aimed to assess the prevalence and identify the key determinants of ARIs in children under five in rural Mysuru, Karnataka, India.

Materials & methods

A community-based cross-sectional study was conducted in rural areas of Mysuru from January to June 2024. A sample of 400 children under five years old was selected using a convenience sampling method. Data on sociodemographic characteristics, clinical characteristics and family background, breastfeeding practices and ARI symptoms and episodes were collected through a semi-structured questionnaire by interviewing the mother of the child. Descriptive statistics like frequency and percentages were used and inferential statistics like the Chi-square test and Fisher's Exact test were used to find the factors associated with ARIs.

Results

The overall prevalence of ARI in the rural area was found to be 46.8 % in the study. Exclusive breastfeeding for six months showed a statistically significant association with acute respiratory infections (ARI) (p = 0.001). 48.3% of exclusively breastfed children experienced ARI. Gender (p = 0.001) and a history of hospital admission (p= 0.000) were also significantly associated with ARI, with female children and previously hospitalized children more affected. Other factors, including age, birth weight, family type, and breastfeeding duration, showed no significant association.

Conclusion

The study demonstrates a clear association between exclusive breastfeeding for six months and a reduced incidence of acute respiratory infections (ARI) among children under five. Additionally, gender and prior hospital admissions were also identified as significant risk factors for ARI, indicating that females and previously hospitalized children are more vulnerable to these infections. These findings suggest the need for enhanced breastfeeding support and targeted interventions to mitigate ARI prevalence in young children.

Keywords: Acute Respiratory Infections, Children under five, Prevalence, Determinants, Rural Mysuru, Cross-sectional study

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INTRODUCTION

Acute respiratory infections (ARIs) are classified as upper respiratory tract infections (URIs) or lower respiratory tract infections (LRIs). The airways from the nostrils to the vocal cords in the larynx, which include the middle ear and paranasal sinuses, make up the upper respiratory tract. The lower respiratory tract covers the continuation of the airways from the trachea and bronchi to the bronchioles and the alveoli [1]. Because of the potential spread of infection or microbial toxins, inflammation, and decreased lung function, ARIs are not limited to the respiratory tract and can have systemic repercussions. Respiratory infections range from mild to fatal, depending on the causative organisms and environmental and host factors [2].

One of the most prevalent infections in people, particularly in children under five, is acute upper respiratory infections. The major burden of disease from acute lower respiratory infection involves pneumonia and bronchiolitis, which are caused by bacteria and respiratory viruses [3,4]. Except during the neonatal period, ARIs are the most common causes of both illness and mortality in children under five, who average three to six episodes of ARIs annually[5]. Due to their anatomical structure, which renders them more prone to infection, such as ongoing lung development, relative immunological immaturity, high risk of infection exposure, breathing closer to the ground, and increased air intake, children under the age of five are more vulnerable to ARI [5]. A notable burden of disease observed in low- and middle-income countries where factors such as overcrowding, poor nutrition, and limited access to healthcare exacerbate their vulnerability."

According to the World Health Organization (WHO), respiratory infections account for 6% of the total global disease burden. Around 6.6 million, under-five aged children's years of age die each year worldwide; 95% of them belong to low-income countries and one-third of the total deaths are due to ARI [6]. It is estimated that Bangladesh, India, Indonesia and Nepal together account for 40% of the global ARI mortality. ARI is responsible for about 30–50% of visits to health facilities and for about 20–40% of admissions to hospitals for under-five children [7] Acute respiratory infection is linked to various modifiable risk factors including demographic, environmental, socio-economic, and nutritional factors. Many studies have shown that comorbid illnesses especially HIV, malnutrition, measles, family history of ARI, low socioeconomic status, inappropriate weaning time, pallor, severe malnutrition and cooking fuel other than liquefied petroleum gas, indoor air pollution, maternal illiteracy, parental smoking behaviour male gender, rural residency and overcrowding associated with ARI [8]. Identifying and mitigating these modifiable risk factors will help prevent and control disease to some extent.

Despite the significant burden of acute respiratory infections on morbidity and mortality among children under five globally, data evaluating the problem, particularly in rural India, remain scarce. Updated and region-specific data on the prevalence and risk factors of ARIs are crucial for informing targeted interventions. Achieving the Sustainable Development Goal on improving health and well-being relies on strengthening efforts to prevent and control ARIs across all WHO regions. This study, based on data collected more recently than previous estimates, aims to determine the prevalence of ARIs in children under five and identify its determinants in a rural area of Mysuru.

Objectives

- To determine the prevalence of acute respiratory tract infections among under-five children and its associated factors in rural areas of Mysuru.

Materials and methods

A community-based cross-sectional study was conducted from January to June 2024 in Suttur, a Rural Field Practice Area attached to JSS Medical College, Mysuru. The study participants were 400 under-five children chosen through a convenience sampling method. The informants were the mothers of the children. Data were collected through house-to-house visits using a pre-tested semi-structured questionnaire. The questionnaire consists of information regarding socio- demographic characteristics of the mother and the child. The associated factors include birth weight, immunization status, family history of bronchial asthma, history of hospital administration. The study included mothers of children under five years

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of age who were willing to participate. Exclusion criteria comprised children under five who were temporarily visiting the rural area and mothers who declined to participate in the study.

Sample size and sampling technique

According to a similar study done by Savita et al [12] in Tamil Nadu, where the prevalence was found to be 41.6%, at a confidence interval of 95% and with an absolute precision of 5% at least 388 participants needed to be studied.

Sample size:

$$n = \frac{Z^2 PQ}{L^2}$$

where, Z=1.96, P= 41.6, Q= (100-41.6) = 58.4, L=5%

Therefore, the required sample size was calculated to be a minimum of 388, However, due to the availability of participants, data was ultimately collected from 400 participants.

Data collection

A pretested, semi-structured, self-administered questionnaire was used to collect participant's data before which, informed consent was obtained. The questionnaire collected information on sociodemographic characteristics such as age, gender, mother's education, and type of family. Clinical characteristics include: birth weight, immunisation status, family history of bronchial asthma, duration of breastfeeding, exclusive breastfeeding, history of bottle feeding, respiratory illness in a year and history of hospital administration.

Statistical Analysis

The data collected will be entered in a Microsoft Excel 2019 spreadsheet followed by analysis using SPSS version 26 (Statistical package for the social science, Licensed to JSSAHER) Windows, Version 26.0. (IBM Corp. Released 2019. IBM SPSS Statistics for Armonk, NY, USA). Descriptive statistics involved reporting of continuous variables as mean ± standard deviation (SD), while categorical variables will be reported in terms of frequency (n) and percentage (%). Inferential statistical tests such as Chi-square tests/Fisher's exact test were used to determine the association between ARI and its determinants. The data distribution was represented using appropriate tables. $P < 0.05$ was considered statistically significant.

Results

Among 400 study participants,the study revealed that the overall prevalence of ARI in the rural area was 46.8% with equal male-female composition, the majority 278(69.5%) belonged to the 1-3 years age group and 112 (28%) were 3–5 years old. 265(66.3%) of children were born with normal birth weight and 135(33.8%) were born with low birth weight. 380 (95%) of the children's mothers were literate. The majority 175(43.8%) belonged to the nuclear family followed by 138(34.5%) belonging to three-generation families. All 400 children who participated were completely immunized. 16(4%) of the study participants had more than 5 episodes of respiratory illness in a year. However, 19% had a history of hospital admission due to ARI. Nearly 83% had no history of bottle feeding and of those who were bottle fed, it was started after 1 year. (Table No.1)

Table No:-1: Socio-demographic and Clinical Characteristics of the Study Subjects (n=400)

VARIABLE	CATEGORY	FREQUENCY, n (%)
Age group (years)	<1	10 (2.5)
	1-3	278 (69.5)
	3-5	112 (28)
Birth weight (kg)	<2.5	135 (33.8)
	>2.5	265 (66.3)
Gender	Male	200(50)
	Female	200(50)
Mother's education	Literate	380 (95)
	Illiterate	20 (5)
	Nuclear	175 (43.8)
Type of family	Joint	87 (21.8)

	Three generation	138 (34.5)
Immunization status	Complete	400 (100)
	Partial	0
Family H/O Bronchial Asthma	Yes	35 (8.8)
	No	365 (91.3)
Duration of Breast feeding (in years)	<1	29 (7.2)
	1-2	132 (33)
	>2	239 (59.8)
Exclusive Breast feeding till 6 months	Yes	387 (96.8)
	No	13 (3.3)
Respiratory illness in a year	None	213 (53.3)
	<5 episodes	171 (42.8)
	>5 episodes	16 (4)
H/O Hospital Admission	Yes	78 (19.5)
	No	322 (80.5)
H/O Bottle feeding	Yes	69 (17.3)
	No	331 (82.8)

Among the 400 study participants, 86 (21%) had cough and cold as their major symptoms. Only 5% of the children had >4 symptoms during the episode. Fever with cough & cold was present in 42(11%) of the children during their ARI episode. 192 (48%) of the under-5 children studied had no symptoms of ARI (Figure 1).

Figure No 1: Symptoms study participants had during the episode of Acute Respiratory Infection (%)

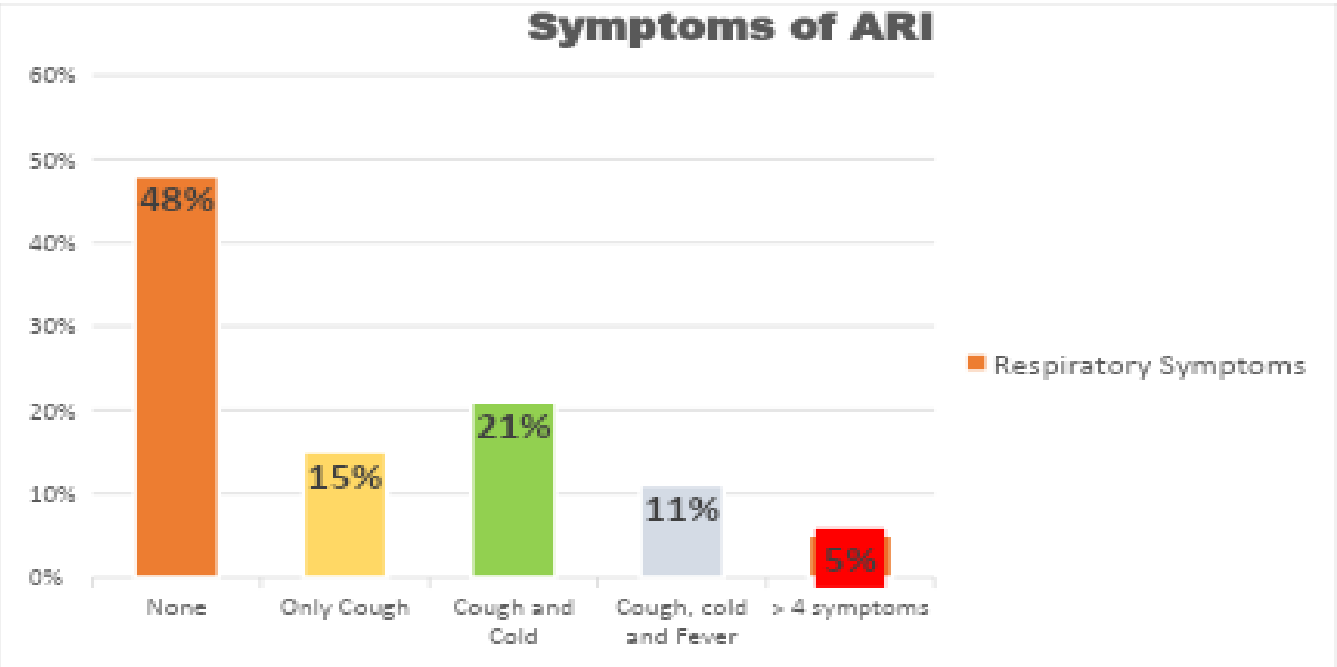

Table No 2: Association between Socio-demographic & Clinical characteristics with Acute Respiratory Infections in under 5 Children.

Variable	Category	Respiratory Illness in a year		Chi-square(X^2)	*p-value*
		Yes (%)	No (%)		
Age group (years)	<1	5(2)	5(2)	1.439	0.48
	1-3	135 (66)	143(67)		
	3-5	67 (32)	65(31)		
Birth weight (kg)	<2.5	54(29)	81(38)	3.73	0.053
	>2.5	133(71)	132(62)		
Gender	Male	77(41)	124(58)	11.565	**0.001***
	Female	110(59)	89(42)		
Mother's education	Literate	178(95)	202(94)	0.26	0.872
	Illiterate	9(5)	11(6)		
Type of family	Nuclear	75(40)	100(47)	4.88	0.087
	Joint	37(20)	50(23)		
	Three generation	75(40)	63(30)		
Family H/O Bronchial Asthma	Yes	16(9)	19(9)	0.017	0.898
	No	171(91)	194(91)		
Duration of Breastfeeding (in years)	<1	14(7)	15(7)	0.625	0.731
	1-2	58(31)	74(3)		
	>2	115(62)	124(90)		
Exclusive Breastfeeding till 6 months	Yes	187(100)	200(94)	11.797	**0.001***
	No	0(0)	13(6)		
H/O Hospital Admission	Yes	64(34)	14(7)	48.504	**0.000***
	No	123(66)	199(93)		
H/O Bottle feeding	Yes	31(17)	38(18)	0.111	0.739
	No	156(83)	175(82)		

p- value <0.05 is statistically significant

Table No. 2 shows gender, exclusive breastfeeding till 6 months and history of hospital admission were the factors found to be statistically associated with ARI in children under 5 (p-value =0.001). Female children show a higher prevalence of ARI compared to male children. The majority of children, 200 (94%) who were exclusively breastfed did not experience respiratory illness. Children with a history of hospital admission have a significantly higher prevalence of ARI. Factors like age, birth weight, mothers' education, family history of bronchial asthma, duration of breastfeeding and history of bottle feeding were not found to be statistically significant.

Discussion

ARIs remain a leading cause of morbidity and mortality among children under five years old, particularly in low- and middle-income countries. [11,12] The study's findings highlight several factors influencing ARI prevalence, notably gender, exclusive breastfeeding, and history of hospital admissions.

Among the 400 study participants, female children exhibited a higher prevalence of ARI at 59% compared to male children at 41%, which may be due to females spending more time indoors in polluted environments (e.g., exposure to indoor cooking smoke). This finding was in contrast with recent research by Fathima Mir et al [13] which suggests that male children were more affected by ARI than female children, biological and environmental factors may contribute to this disparity. This highlights the need for targeted

interventions, including community education to promote equitable health practices and reduce environmental exposures like indoor air pollution.

Exclusive breastfeeding until six months was associated with a lower incidence of ARI, with 51.6% of exclusively breastfed children not experiencing respiratory illness. This protective effect is well-documented, as breastfeeding provides essential nutrients and antibodies that enhance the infant's immune system. According to a previous study done by Geberstadik et al [15] in the Ethiopian Demographic and Health Survey data emphasized that malnutrition is a key modifiable risk factor for ARI in children under five and that the risk of ARI decreases as the age of the child increases. Therefore, promoting exclusive breastfeeding practices is crucial in ARI prevention strategies.

The current study also noted that children with a history of hospital admission had a significantly high prevalence of ARI of 34%. This correlation may indicate that children who have been hospitalized possess underlying vulnerabilities, such as compromised immunity or chronic health conditions, predisposing them to recurrent infections. Additionally, hospital environments can expose children to nosocomial infections, potentially increasing ARI risk.[14,16] A study in Uganda done by Nshimiyimana Y et al [17] analyzed risk factors of ARI symptoms among children under five, highlighting the importance of addressing underlying health issues to reduce ARI incidence.

Interestingly, factors such as age, birth weight, maternal education, family history of bronchial asthma, duration of breastfeeding, and history of bottle feeding were not statistically significant in this study. This contrasts with other research that identifies low birth weight and poor maternal education as risk factors for ARI. A study done by Tazinya AA et al [18] found that poor maternal education was associated with higher ARI incidence. These discrepancies may result from differences in study populations, methodologies, or regional variations, underscoring the need for context-specific investigations.

Among the 400 study participants, 21% had cough and cold as their major symptoms, and only 4% experienced more than four symptoms during an ARI episode. Fever with cough and cold was observed in 11% of the children. These findings suggest that while a subset of children experiences mild to moderate symptoms, the overall symptom burden remains low for most participants. Similar patterns have been observed in a study conducted by Das et al [20], which indicate that cough and fever are the most common clinical presentations of ARI in children under five . The relatively low proportion of children with severe symptoms may reflect the benefits of high immunization coverage (100% in this study) and maternal literacy (95%), which contribute to better health awareness and early care-seeking behaviour.[19,21] Addressing mild cases through community health interventions and ensuring access to timely medical care for severe cases can further reduce the ARI burden.

This study, while offering valuable insights into the prevalence and determinants of acute respiratory infections (ARIs) among children under five in a rural area, has certain limitations. First, the study utilized convenience sampling, which may introduce selection bias and limit the generalizability of the findings to other populations. The high rates of immunization (100%) and maternal literacy (95%) in the study population likely influenced the results, potentially underestimating the burden of severe ARI symptoms compared to settings with lower immunization coverage and literacy rates. Additionally, while the study measured key variables such as symptom patterns and maternal literacy, it did not account for other potentially relevant factors, such as household air pollution, seasonal variations, or nutritional status, which could provide a more comprehensive understanding of ARI risk factors.

Conclusion

The high prevalence (46.8%) highlights the substantial burden of ARIs in this vulnerable population and underscores the need for sustained public health efforts to address this issue. The findings reinforce the critical role of certain factors, including gender, exclusive breastfeeding, and prior hospital admissions, in influencing ARI susceptibility. Exclusive breastfeeding emerged as a protective factor, emphasizing the importance of promoting optimal infant feeding practices as a cornerstone of ARI prevention. Similarly, children with a history of hospitalizations were identified as being at higher risk, indicating the need for closer monitoring and targeted interventions for this

subgroup.

Future studies should aim to address these limitations by adopting random sampling techniques to enhance the representativeness of the study population and reduce selection bias. Expanding the scope to include additional variables such as environmental factors, seasonal trends, and dietary patterns could provide a more understanding of ARI determinants. Incorporating longitudinal designs could help track ARI episodes over time, offering insights into their seasonal and long-term patterns. Moreover, conducting similar studies in diverse settings with varying immunization and literacy rates would enhance the generalizability of findings and provide a broader understanding of ARI burden across different regions.

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